A Robust Multi-scale Modeling System for the Study of Cloud and Precipitation Processes

Wei-Kuo Tao

During the past decade, numerical weather and global non-hydrostatic models have started using more complex microphysical schemes originally developed for high-resolution cloud resolving models (CRMs) with 1-2 km or less horizontal resolutions. These microphysical schemes affect the dynamic through the release of latent heat (buoyancy, loading and pressure gradient), the radiation through the cloud coverage (vertical distribution of cloud species), and surface processes through rainfall (both amount and intensity).

Recently, several major improvements of ice microphysical processes (or schemes) have been developed for cloud-resolving model (Goddard Cumulus Ensemble, GCE, model) and regional scale (Weather Research and Forecast, WRF) model. These improvements include an improved 3-ICE (cloud ice, snow and graupel) scheme (Lang et al. 2010); a 4-ICE (cloud ice, snow, graupel and hail) scheme and a spectral bin microphysics scheme and two different two-moment microphysics schemes.

The performance of these schemes has been evaluated by using observational data from TRMM and other major field campaigns. In this talk, we will present the high-resolution (1 km) GCE and WRF model simulations and compared the simulated model results with observation from recent field campaigns [i.e., midlatitude continental spring season (MC3E; 2010), high latitude cold-season (C3VP, 2007; GCPEx, 2012), and tropical oceanic (TWP-ICE, 2006)].